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Original Article

Factors associated with injury in REM sleep behavior disorder

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ABSTRACT

Objective: As factors associated with injury in rapid eye movement (REM) sleep behavior disorder (RBD) remain largely unknown, we aimed to identify such factors.
Methods: We surveyed consecutive idiopathic (iRBD) or symptomatic RBD patients seen between 2008 and 2010 regarding RBD-related injuries. Associations between injuries and clinical variables were determined with odds ratios (OR) and multiple logistic regression analyses. The primary outcome variables were injury and injury severity.
Results: Fifty-three patients (40%) responded. Median age was 69 years, and 35 (73.5%) were men. Twenty-eight (55%) had iRBD. Twenty-nine (55%) reported injury, with 37.8% to self and 16.7% to the bed partner. 11.3% had marked injuries requiring medical intervention or hospitalization, including two (4%) subdural hematomas. iRBD diagnosis (OR = 6.8, $p = 0.016$) and dream recall (OR = 7.5, $p = 0.03$) were associated with injury; and iRBD diagnosis was independently associated with injury and injury severity adjusting for age, gender, DEB frequency, and duration. Falls ($p = 0.03$) were also associated with injury severity. DEB frequency was not associated with injury, injury severity, or falls.
Conclusions: Injuries appear to be a frequent complication of RBD, although the relatively low response rate in our survey could have biased results. iRBD patients are more likely to suffer injury – and more severe injuries – than symptomatic RBD patients. In addition, recall of dreams was also associated with injury, and dream enactment behavior (DEB)-related falls were associated with more severe injuries. One in nine patients suffered injury requiring medical intervention. The frequency of DEB did not predict RBD-related injuries, highlighting the importance of timely initiation of treatment for RBD in patients having even rare DEB episodes. Future prospective studies will be necessary to define predictors of injury in RBD.

1. Introduction

Rapid eye movement (REM) sleep behavior disorder (RBD) is a parasomnia characterized by dream enactment behavior (DEB) associated with the loss of normal skeletal muscle atonia resulting in abnormal, excessive motor activity often mirroring dream content during REM sleep [1]. RBD results in motor activity ranging from simple limb twitches to more complex and violent movements that may result in injury to the patient and/or their bed partner [2–11]. Large population-based studies report the prevalence of RBD to be 0.38–0.5% [2,8,12]. However, probable RBD may occur in over 6% of community-dwelling 70–89-year-old individuals, suggesting that RBD prevalence, and therefore possible resultant injury, may be considerably higher than previously believed, particularly in vulnerable elderly patients [3,5]. RBD is predominantly seen in men over age 60; however, prior to age 50, women and men are equally likely to develop RBD [8,13–16]. There are two diagnostic categories for RBD, idiopathic (iRBD) or symptomatic, which we defined as those patients having RBD symptoms and a comorbid synucleinopathy

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neurodegenerative disease including Parkinson's disease (PD), dementia with Lewy bodies (DLB), or multiple system atrophy (MSA) [2,7,8,10,17,18]. However, because approximately 80% of iRBD patients develop parkinsonism or cognitive decline over longitudinal follow-up, iRBD is considered to be an early clinical manifestation of synucleinopathy neurodegenerative disorders with varying rates of disease progression presenting up to 50 years prior to the development of overt cognitive or motor decline [2,4,7,8,10,17–19].

The association of RBD and injury is widely acknowledged, occurring in 33–96% of patients and/or their bed partners [2,10,20,21]. However, very little is known regarding what factors predispose a RBD patient or their bed partner to injury. DEB can vary from harmless (i.e., singing or feigning knitting) to more dangerous behaviors (i.e., kicking, punching, or firing unloaded weapons), which may result in mild injuries such as bruises to more severe injuries such as limb fractures and subdural hematomas [2,8,10,21–23]. The goals of RBD treatment are to reduce DEB frequency and prevent injury, with the presumption that minimizing DEB may reduce injury occurrence [2,10,21,24]. Clonazepam and melatonin are used to reduce the frequency and severity of DEBs [25]. We aimed to identify which factors are associated with injury in RBD patients.

2. Methods

2.1. Ethics

The Mayo Clinic Institutional Review Board provided human subjects research approval for this study and oversight of its study activities.

2.2. Subjects

A diagnosis and text-based search identified 641 newly diagnosed patients with RBD at our institution between 1/1/2000 and 12/31/2009. Given the difficulty in designing suitable survey measures for children who may not have witnessed sleep to accurately report on DEBs, we excluded patients <18 years of age, resulting in 608 eligible subjects. All included patients met the standard diagnostic criteria for RBD, including the presence of REM sleep without atonia (RSWA) during polysomnography, a history of sleep-related injurious or potentially injurious disruptive behaviors, and/or abnormal DEBs during polysomnography, absence of REM-related epileptiform activity, and absence of another sleep disorder that better explained their sleep disturbance [1]. We mailed a survey to 133 patients seen between 2008 and 2010, limiting the study sample to these years to reduce recall bias. Fifty-three (40%) surveys were returned and analyzed. Seventy-eight patients did not respond, and two patients died before return of surveys.

2.3. Survey instrument

We designed a questionnaire, which was completed by patients together with a bed partner who had observed their RBD, that surveyed demographics; baseline RBD behavioral characteristics prior to treatment including frequency, severity, and type of behaviors, ratings of limb movement intensity, and occurrence and quality of vocalization; and occurrence and frequency of falls from bed and patient or bed partner injury specifically related to DEBs with qualitative descriptions of any injuries. Injuries unrelated to DEB were not assessed. Injury was considered a binary variable and delineated by patient or bed partner injury. Injury severity was defined as a categorical variable ranging from mild (no lasting signs), moderate (bruises), or marked (injury requiring medical attention such as a laceration or fracture). This survey instrument is shown in Supplemental/Online Appendix S1.

2.4. Clinical data

We reviewed medical records to confirm RBD diagnostic type as either idiopathic or symptomatic at the time of initial clinic visit during the 2008–2010 time period, as well as follow-up clinical data at the time of survey completion to verify persistence of the original diagnosis at the time of survey responses. We also reviewed demographic information and medication dosages and abstracted clinically important covariates including neurologic and psychiatric history, antidepressant administration, and polysomnography data. Patients with comorbid neurological and sleep disorders met the criteria for clinically probable DLB, mild cognitive impairment (MCI), PD, MSA, obstructive sleep apnea (OSA), and restless legs syndrome (RLS) [1,25].

2.5. Data analysis

Study data were collected and managed using REDCap electronic data capture tools [26]. Statistical calculations were carried out using JMP statistical software (JMP, Version 9. SAS Institute Inc., Cary, NC, USA). Qualitative and ordinal data were reported as absolute and relative frequencies, while quantitative data were reported as medians and interquartile range (IQR). Wilcoxon rank-sum tests were used to compare continuous outcomes. Categorical variables were compared with contingency tables, chi-squared tests, and odds ratios (ORs) with determination of 95% confidence intervals (CIs) between injury and noninjury groups. Univariate logistic regression analyses were performed to determine potential associations between primary dependent variables including injury (whether to self, bed partner, or both) and injury severity. Variables approaching significance using univariate analysis were then fit into multiple logistic regression models. Unit ORs with 95% CIs were then determined. The significance level was set at an alpha of $p < 0.05$.

3. Results

3.1. Demographics and clinical data

Key demographic and clinical RBD data for all subjects are summarized in Table 1, including the group of patients who reported injury and those who did not. Of the 53 respondents, 39 (73.5%) were men with a median age of 69 years (IQR = 16.5). The median age of RBD symptom onset was 57 years (IQR = 16). The median duration of RBD symptoms was 8 years (IQR = 13.8). Twenty-eight (55%) of patients had iRBD at the time of polysomnography and RBD diagnosis; 11 of these 28 patients were seen in follow-up after survey completion and remained idiopathic, while the remaining 17 patients had a mean duration between last clinical follow-up and survey completion of 22.3 months. Twenty-five (45%) patients who had comorbid neurodegenerative disease were classified as having symptomatic RBD at the time of polysomnography and RBD diagnosis. Ten (40%) had PD, nine (36%) had DLB/MCI, and six (24%) had MSA. Twenty-three (43%) patients had comorbid depression and 25 (47%) were on antidepressant medications, including both selective serotonin and norepinephrine reuptake inhibitors. Thirty-five (66%) patients had OSA, 12 (23%) had RLS, 33 (61%) had ≥15 periodic leg movements of sleep per hour, and 30 (57%) reported hypersomnolence with a median Epworth Sleepiness Scale Score of 16 (IQR = 6). Patients diagnosed with comorbid OSA (apnea hypopnea index (AHI) ≥ 5) had a median AHI of 12 per hour (IQR = 23.25), and the median AHI for the entire cohort was 3 (IQR = 11); however, all RBD patients with OSA diagnoses met International Classification of Sleep Disorders – Second Edition (ICSD-2) RBD diagnostic criteria with evidence for polysomnographic RSWA and had persisting dream enactment episodes following successful treatment of OSA (i.e., none of these patients appeared to have "pseudo-RBD") [27].

Table 1
Demographic and clinical variables of all RBD patients, and the groups reporting injury or no injury prior to treatment.

	All ($n = 53$)	Injury ($n = 29$)	No Injury ($n = 24$)
Demographics, median (IQR)			
Age	69 (16.5)	67 (18.3)	71 (11)
Age of RBD onset	57 (16)	56 (11)	57 (17.3)
RBD duration	8 (13.8)	8.6 (10.5)	7.7 (18.8)
Sex, *n* (%)			
Male	39 (73%)	21 (72%)	18 (75%)
Female	14 (27%)	8 (28%)	6 (25%)
Idiopathic RBD Patients *n* (%)	28 (53%)	22 (76%)	6 (25%)
Neurodegenerative Dx, *n* (%)			
Synucleinopathy at RBD Dx*	25 (47%)	7 (24%)	18 (75%)
PD**	10 (19%)	2 (7%)	8 (33%)
DLB	2 (4%)	1 (3%)	1 (3%)
MCI	7 (13%)	2 (7%)	5 (21%)
MSA	6 (11%)	2 (7%)	4 (17%)
Depression	23 (43%)	14 (48%)	9 (38%)
Sleep Disorder, *n* (%)			
OSA	35 (66%)	18 (62%)	17 (71%)
RLS	12 (23%)	7 (24%)	5 (17%)
PLMD	33 (61%)	16 (55%)	17 (71%)
Medication, *n* (%)			
Antidepressant	25 (47%)	13 (48%)	12 (50%)
SSRI	14 (26%)	7 (24%)	7 (29%)
SNRI/Bupropion	11 (21%)	6 (21%)	5 (21%)
Dopaminergic	12 (23%)	5 (17%)	7 (29%)
Anticholinergic	6 (11%)	2 (7%)	4 (17%)
RBD Characteristics			
^Severity of limb movement#	2.5	2.7	2.2
Recalled dreams$ n (%)	40 (75%)	27 (93%)	13 (54%)
Dream content, *n* (%)			
Fight theme	19 (36%)	13 (45%)	6 (25%)
Chase theme	9 (17%)	6 (21%)	3 (13%)
Other	8 (15%)	6 (21%)	2 (8%)
Falls from bed during DEB, *n* (%)	31 (58%)	20 (69%)	11 (46%)

PD, Parkinson's Disease; DLB, Dementia with Lewy Bodies, MCI, Mild Cognitive Impairment; MSA, Multiple System Atrophy; OSA, Obstructive Sleep Apnea; RLS, Restless Legs Syndrome; PLMD, Periodic Limb Movement Disorder; SSRI, Selective Serotonin Reuptake Inhibitor; SNRI, Selective Norepinephrine Reuptake Inhibitor.
* $p = 0.01$, ** $p = 0.01$, ^ Severity of limb movement scored 0–3, 0 = no movement, 3 = Thrashing/violent moving, # $p = 0.028$, $ $p = 0.002$.

Demographic data were similar between groups in which injury occurred versus no injury, with the exception that patients who injured themselves or their bed partners were more likely to have iRBD ($p = 0.01$), more dream recall ($p = 0.002$), and more severe DEB-related limb movement ($p = 0.025$) compared to those who suffered no injury (Table 1). There were no differences between idiopathic ($n = 25$, 89%) and symptomatic ($n = 23$, 92%) RBD groups for bed partner availability for survey completion.

3.2. Injury data

Twenty-nine (55%) patients reported injury prior to treatment. Self-injury occurred most frequently in 20 patients (37.8%), while injuries to the bed partner occurred in nine respondents (16.7%). Within the group of patients reporting injury, eight (27%) injured both themselves and their bed partner. Only six (21%) patients (four iRBD, two symptomatic RBD) who reported injury presented to our sleep center with occurrence of DEB-related injury within 6 months prior to presentation, and none of these patients had sleep-related injury as a primary complaint or reason for referral to the sleep center. Marked injuries requiring either outpatient medical intervention or hospitalization occurred in 11.3% of all patients. Of those suffering injury, reported injury severity was mild in 20.7%, moderate (bruises or visible injury) in 58.6%, and marked in 20.7%. Thirty-one patients (58%) reported falling out of bed during dream enactment. Injuries suffered, dream enactment, and dream content varied widely among patients. Two patients (4%) suffered subdural hematomas after falling out of bed (Fig. 1). The range of qualitative descriptions of reported injuries and frequency of injury types are summarized in Table 2.

The 28 patients with iRBD were significantly more likely than patients with symptomatic RBD to have injured themselves during DEB (OR = 7.7, CI = 1.9–31.4, $p = 0.002$), and when only the 11 patients with iRBD diagnosis seen after survey completion were similarly analyzed, this association became stronger, although CIs widened (OR = 19.0, 3.6–138.0, $p = 0.003$). iRBD diagnosis was an independent predictor of injury to the patient ($p = 0.008$) after adjusting for age, gender, and frequency of DEB. PD was the only synucleinopathy subtype independently associated with a lower frequency of reported RBD-related injury after adjusting for age and gender ($p = 0.02$). iRBD diagnosis (OR = 6.8, CI = 1.4–40.7, $p = 0.016$) and dream recall (OR = 7.5, CI = 1.2–68.7, $p = 0.03$) were both independently associated with injury to patient and/or bed partner adjusting for age, gender, frequency of DEB, and RBD duration. When 11 iRBD patients whose diagnosis was again verified after survey completion were similarly analyzed, this association again appeared stronger, albeit with wider CIs (OR = 10.7, CI = 2.1–83.2, $p = 0.003$).

A greater severity of patient/bed partner-perceived limb movement was associated with bed partner injury ($p = 0.046$) after adjusting for age, sex, and RBD duration. iRBD diagnosis also increased the likelihood of more severe injury to patient or bed partner

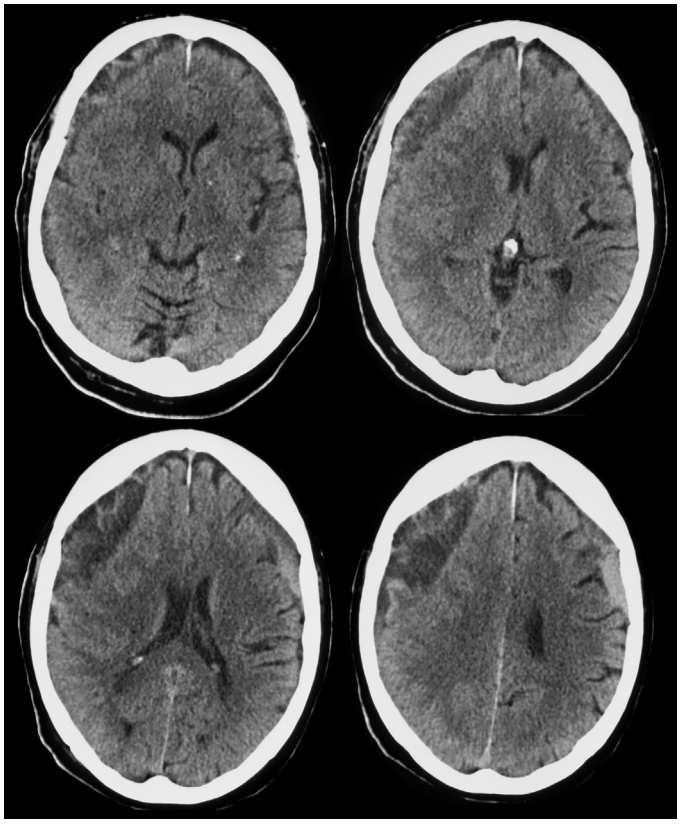

Fig. 1. Subdural hematoma in a 77-year-old man with idiopathic REM sleep behavior disorder. The patient dreamt he was catching a punt while playing football and dove out of bed striking his head on the floor. He reported gait instability in subsequent weeks and was found to have large bilateral frontal subdural hematomas requiring burr hole evacuation. Five years after this event, he began developing cognitive decline and was subsequently diagnosed with Lewy body dementia.

(OR = 10.9, CI = 2.9–54.5, $p = 0.0002$), and when reanalyzed with only the 11 iRBD patients seen after survey completion, this association held (OR = 12.0, CI = 2.4–78.5, $p = 0.002$). In addition, iRBD ($p = 0.0002$) and falling out of bed during DEB ($p = 0.03$) both independently predicted more severe injuries after adjusting for age, gender, and RBD symptom duration.

The frequency of DEB was not associated with injury, falling out of bed, or severity of reported injuries. Comorbid depression, OSA, antidepressant use, or dopaminergic drug use were not associated with injury or frequency of DEB. In addition, dream type (fighting vs. chasing) and vocalization (mumbling vs. screaming or shouting) were not predictive of injury. However, a younger age at RBD symptom onset was associated with more frequent DEB ($p = 0.02$) after adjusting for gender, RBD symptom duration, and antidepressant use.

4. Discussion

Patients with iRBD were more likely to injure themselves than those with symptomatic RBD. In addition, patients who reported more severe limb movement during DEB (such as thrashing and kicking) had a greater chance of injuring their bed partners. iRBD diagnosis and DEB-related falls from bed were associated with more severe injuries in patients and their bed partners. Interestingly, DEB frequency was not predictive of injuries or falls, suggesting that RBD patients should receive treatment to prevent injury potential, regardless of the reported DEB symptom frequency. In addition, DEB-related injury was not seen as a presenting complaint at our sleep center, suggesting that patients may not be particularly troubled by injury potential. However, given the frequency of injury that was eventually reported in our patients, appropriate treatment strategies to prevent future injury needs to be considered early in the course of patient evaluation.

To our knowledge, this is one of the first reports on clinical factors associated with injury in RBD patients. The clinical features of our respondents including older age, frequent neurodegenerative disorders (45%), antidepressant use (47%), and frequent injury (55%) are similar to previous large RBD case series [10,19,28]. Injuries suffered by our patients and their bed partners ranged from simple bumps and ecchymosis to bloody feet and subdural hematomas, also similar to previously reported injuries [2,10,21,22].

Our data suggest that patients with symptomatic RBD, specifically patients with PD, are less likely to injure themselves than patients with iRBD. Patients with RBD and PD have been shown to be more likely to fall from the bed and injure themselves compared to PD patients without RBD, but previous studies have not compared injury in iRBD to PD-RBD [20,29]. While we were not able to assess the temporal course of RBD frequency severity or injury potential in this retrospective cohort, iRBD patients could possibly have more injurious and severe DEBs initially, with DEBs becoming milder and less frequent as the underlying synucleinopathy progresses. Investigators have previously reported that RBD symptoms may decrease over time in 26–35% of patients with progressive neurodegenerative disorders, with spontaneous remission of clinical RBD symptoms in 14–30% of PD-RBD patients per year [10,30–33]. Other studies have reported that the clinical course for RBD symptoms may initially follow a progressively worsening course, followed by a static phase, then a subsequent decrease in DEB later in the disease [12]. In addition, iRBD patients have been reported to have more severe DEBs and greater dream recall than PD and MSA patients with RBD, although dream recall or frequency and severity of DEB were not associated with RBD disease status in our cohort [34].

Decrease in RBD symptoms with progressive neurodegeneration has been suggested to be due to decreased patient functionality, more disrupted sleep, or increased muscle rigidity rather than a decrease in lesional pathology, which could partially explain fewer

Table 2
Frequency of reported injury types in RBD patients.

Injury type, *n* (% of injured patients)	
Mild	6 (20.7%)
Moderate	17 (58.6%)
Marked	6 (20.7%)
Injury demographics *n* (% total patients)	
Self	20 (37.8%)
Bed partner	9 (17%)
Both self and bed partner	8 (15%)
Injuries to patients (*n*, % total patients)	
Subdural hematoma	2 (4%)
Forehead laceration	2 (4%)
Fractured/bruised ribs	2 (4%)
Shoulder sprain	1 (2%)
Bloody feet	1 (2%)
Bruises	12 (23%)
Injuries to bed partners *n* (% injured bed partners)	
Bruises	6 (67%)
Open arm wound	1 (11%)
DEB descriptions resulting in marked/moderate injury	
Strangled wife	
Fell out of bed hitting head on floor while being chased by “men with guns”	
Threw daughter across room after mistaking her for attacking bear	
Bit wife's arm which required suturing for repair	
Put head through wall resulting in neck soreness	
Ran across room into the wall	
Fell out of bed trying to catch a punt	
Punched bed partner in face	

injuries reported by our symptomatic RBD patients. Interestingly, patients with PD were least likely to suffer an injury, possibly due to degraded motor functioning in PD, rendering DEB less violent. In addition, our patients with synucleinopathy were older than iRBD patients, thereby potentially not being as physically capable of injurious movements. Contrarily, RBD patients have been reported to display extraordinary strength during DEB episodes, so age alone may not be indicative of injury potential [22]. One large video-polysomnogram study found that DEB movements in PD-RBD patients were more fluid than waking movements, suggesting that corticospinal motor projections may "bypass" the basal ganglia, leading to more jerky and violent movements in REM sleep than during wakefulness when basal ganglia processing results in smoother movements [22]. An alternative explanation for our finding that PD-RBD patients were less prone to injury than iRBD patients may have been presentation bias in our retrospective study, although the dearth of sleep-related injury at presentation in our study cohort does not suggest this to be likely. Prospective studies will surely be necessary to further clarify the reasons why PD-RBD patients may be less injury prone despite polysomnographic evidence for more vigorous REM related than waking motor activity.

We found that younger age was associated with more frequent DEB episodes, potentially increasing opportunities for injury. However, the frequency of DEB was not associated with injury, which is consistent with one previous report regarding violent behaviors during sleep [35]. In addition, previous reports in patients with PD and RBD have indicated that fighting dream mentation and injury are more common in men than women [36]. However, no gender differences were seen in injury occurrence or dream content in our cohort.

DEB-related falls from the bed predisposed patients to more severe injury. More severe limb movements during DEB were associated with bed partner injury and injury severity, intuitively sensible as larger, purposeful, and forceful movements such as punching and kicking would seem more likely to make contact with and potentially injure the bed partner.

Interestingly, patients who recalled their dream content were more likely to injure themselves or their bed partners. Dream mentation including fights or chases was reported by 53% of patients. Several previous series have reported that aggressive dream content in RBD patients was frequent when compared with age- and gender-matched controls without an apparent correlation with waking aggressiveness [21,34,37,38]. Recall bias could confound this potential association, as patients could be likely to remember dreams in which they hurt themselves or their bed partners. However, as suggested previously [39], patients who have more vivid dreams could also be more likely to have complex behaviors resulting in injury. As RBD treatment decreases both DEB frequency and violent dream content, both dreams and behaviors in RBD may have a common neuronal generator [21,28,38,39]. If this is the case, then patients who have more vivid dreams could be more likely to have more complex and violent DEB leading to injury.

In our cohort, 58% of patients reported falling out of bed during DEB, similar to a previously reported large series [10]. The risk of falling should be addressed when counseling RBD patients regarding the importance of bedroom safety. Bed rails and mattresses can be placed on the floor to protect against injury as a result of falling out of bed during DEB. A novel bed alarm device could also potentially be a useful adjunctive therapy to alert RBD patients and/or their bed partners to possible danger if the patient falls or has left the bed [40].

A surprising and somewhat counterintuitive finding of our study was that the frequency of DEB was not associated with injury to either the patient or their bed partner, falling out of bed, or severity of injury, suggesting that DEB frequency, severity, and injury may actually be decoupled in RBD highlighting the importance of considering treatment for each RBD patient, as injury may occur at any time. The practical implication of this data is that RBD patients should be treated to prevent injurious complications even when DEBs are infrequent. The two main treatment options used for RBD are melatonin and clonazepam. Melatonin was recently reported to be as effective as clonazepam in decreasing DEB, especially in neurologically sensitive patients, with fewer side effects [2,7,8,10,21,24,25].

A strength of our study is its focus on injury characteristics in a relatively large, representative, naturalistic clinical practice sample of RBD patients with an acceptable response rate having comparable clinical characteristics to those reported in most previously published large case series [4–6,10,21,24,25]. However, our study has several notable limitations. Given the relatively low response rate of 40% overall, concern over respondent bias exists, as it is possible that patients having more severe or recent injuries could be more likely to have responded to our survey, which could falsely raise estimates of the frequency and severity of injury in this series. As a survey of injuries occurring in RBD, it is difficult to determine timing of falls and injury and whether or not these occurred concomitantly or as separate events. In addition, it is very likely that we may not have been able to identify and control for several potential confounding biases in selection, referral, sampling, response, and recall. Presumably, our cases may be more likely to have more frequent and/or severe RBD than those evaluated in community-based sleep disorder centers, and thus our conclusions may not be generalizable to all RBD patients. Furthermore, it could be argued that patients with symptomatic RBD may have been more prone to cognitive impairments that limited their recall of past injuries prior to treatment as compared to iRBD patients with preserved cognitive functioning. Last, we were unable to perform neurological examination at the time of survey response for all subjects and therefore based categorization of iRBD or symptomatic RBD diagnosis status on the last clinical follow-up, possibly leading to miscategorization and underestimation of patients who may have converted from iRBD to symptomatic RBD at the time of injury, a particular concern as recent evidence suggests that approximately 81% of patients with iRBD eventually develop overt symptoms and signs of neurodegeneration with serial long-term neurological follow-up [18,41]. Misclassification of iRBD or symptomatic RBD diagnosis may have led to an overestimation of the association of iRBD diagnosis type with injury and injury severity. However, we were able to verify progression-free status and iRBD in 11 of 28 subjects, and the remaining iRBD subjects had a mean duration between the last clinical follow-up and survey completion of 22.3 months, suggesting that the majority of our iRBD patients were accurately classified. Additionally, we reanalyzed the data for associations between iRBD and injury and injury severity only including the 11 iRBD patients whose diagnoses were verified again following survey completion (thus confirming their status at time of survey completion), and found similar, and even stronger, associations, although given the smaller number of subjects, CI estimates widened as expected. Future prospective studies will be necessary to address these inherent methodological problems in survey-based research and to determine the impact and timing of injuries and potential injury-provoking events such as falls to further delineate the relationship between injuries and iRBD and symptomatic RBD diagnosis type, DEB frequency and severity, as well as the impact of treatments on injury potential.

Our data show that iRBD patients appear to be more likely to suffer injury than symptomatic RBD patients, and that frequency of DEB does not appear to predict either injury or injury severity, a surprising finding which suggests that treatment should be considered for all patients reporting RBD symptoms regardless of frequency and severity of behaviors to prevent their potential for injury. Melatonin may be a particularly useful treatment to consider for

symptomatic RBD patients, given that these patients may be less prone to injury, but also as symptomatic patients may be more sensitive toward adverse treatment effects such as cognitive dysfunction or drug interactions with other centrally active dopaminergic or anticholinesterase medications. In addition, bedroom safety must be addressed for all patients with RBD to prevent injurious falls from bed. We plan to conduct future prospective studies to better define predictors of injury in RBD.

Disclosures

There was no off-label medication use associated with this project.

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Conflict of interest

The ICMJE Uniform Disclosure Form for Potential Conflicts of Interest associated with this article can be viewed by clicking on the following link: http://dx.doi.org/10.1016/j.sleep.2014.06.002.

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Appendix: Supplementary material

Supplementary data to this article can be found online at doi:10.1016/j.endend.2013.05.004.

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